think only (2) and (3) necessary: they elaborate a theory of life consistent with itself, and apparently satisfactory in its application to conduct, but are less careful to test its harmony with facts derived from the senses. But all three are necessary.[1] The first furnishes material; the second constructs the building; the third tests its suitableness for human habitation. All admit that successful application to art is the best test of true theory. But conduct is the art corresponding to our theory of life, and therefore the *test of its truth*. Now, is not immortality as an element of our theory of life in the highest degree conducive of right conduct? Is it not a useful, yea a necessary, element in a working hypothesis?

4. But it may be objected, animals, too, have brains: in them, too, we find evidences of something like consciousness and thought. Are they, too, immortal? If so, where shall we stop? We pass down by sliding scale, without break, to the lowest verge of life. Shall we stop here? No: for vital is transmutable into physical forces. Thus all is immortal, or none. Thus hope of immortality vanishes, as it were, by evaporation.

This objection, though serious, is, we think, not fatal. To make our view clear, we use an illustration taken from biology. May we not imagine that in animals spirit is in embryo in the womb of Nature, unconscious of self, and incapable of independent life; and that in man it came to birth, — a separate spirit, — individual, conscious of self, and capable of independent life, on a new and higher plane? According to this view, geological time is the period of gestation, evolution is the process of development, and the appearance of man the act of birth.[2] JOSEPH LE CONTE.

THE BRITISH MUSEUM OF NATURAL HISTORY.

THE visitor to the west end of London is confronted, upon turning into Cromwell Road, by a large and majestic building, whose architectural grace and warm color make a very pleasing impression upon the eye. This recent addition to the splendors of the West End is the home of the natural-history departments of the British museum. By its completion the plans of certain prominent English naturalists are happily consummated. As early as 1854 Dr. Edward Gray, alarmed by the rapid growth of the national collection of objects from the three kingdoms of nature, memorialized the trustees of the British museum upon the necessity of better accommodations. In 1862 the matter received careful attention from Professor (now Sir) Richard Owen, who published an elaborate essay upon the proper scope of a national natural-history museum, in which he presented plans for the division of material, and the erection of a museum building. These and other plans were thoroughly discussed by the naturalists of England, and the critics became eventually divided into two opposing factions, — the one maintaining that it was best to hold the natural-history collections in Great Russell Street by an enlargement of the original edifice; and the other, that it was more desirable to erect a new building somewhere in the western part of the metropolis, where more air and a better light could be obtained. The latter view finally prevailed in the government councils; but, by reason of a combination of unfortunate circumstances, nothing was done toward the erection of a new building for nearly twenty years. The collections were not moved from Great Russell Street until the autumn of 1880.

The new building stands upon a part of the ground allotted to the great industrial exhibition of 1851. Near it are the South Kensington and Indian museums, and the structures occupied by transient displays, such as the recent fisheries and hygienic exhibitions. The main portion of the building faces Cromwell Road, and presents a frontage of about six hundred and fifty feet. The two central towers are flanked on either side by a long wing and a terminal pavilion. The wings are three stories high, with a basement. The style of architecture is Norman-Gothic, richly ornamented with animal forms and conventional figures drawn from animate objects. At the back of the principal part of the structure are a number of single-storied annexes, running out at right angles to the main wall. Light for the rooms at the front and sides is obtained through large windows reaching down to the floor, but the annexes are lighted from the top.

The entire building is constructed of a buff-colored terra-cotta, which, as already intimated, is elaborately modelled, especially about the windows and doorways. The walls of the interior are likewise ornamented with conventional figures in relief. The ceiling of the central hall, presently to be mentioned, is inlaid with wooden panels upon which are painted representations of different species of plants in life-colors. The floor is a rich marble mosaic.

[1] Reflex action and theism. WILLIAM JAMES. *Unitarian review* for November, 1881.
[2] *Princeton review* for November, 1878.

The main entrance leads into the great central hall, a hundred and fifty feet long, ninety-seven feet wide, and about sixty feet high, lighted by windows near the roof, and having a gallery on the sides at the level of the second story, reached by a grand staircase at the back. The ground-floor of this hall is occupied by the index collection, which is lodged in twelve arched alcoves on the east and west sides. It also gives room to a great sperm-whale skeleton, which is the first specimen one sees upon entering the building.

Back of the central hall is another somewhat smaller, — ninety-seven feet by seventy feet, — which will be devoted to the collection illustrative of the British fauna.

On the west side of the central hall is the entrance to the bird gallery, which occupies the entire first story of the west wing and terminal pavilion. The wing is two hundred and thirty-three feet long and fifty feet wide; the pavilion, sixty feet by forty feet. The east wing and pavilion, which are of like proportions, are occupied by the fossil mammalia. Between the back wall of the wings and the annexes previously mentioned is a long narrow corridor lighted from above. The western corridor is occupied by coelenterates and sponges, and the eastern by fossil reptiles. Each of the annexes is occupied by a single group. The most westerly room contains mollusks, after which follow echinoderms, reptiles, crustaceans, and fishes. The annexes at the east of the central hall contain fossil fishes and various groups of fossil invertebrates. It will be perceived that the eastern half of the first story is devoted to fossil animals, while the western half is occupied by a portion of the collection of recent animals. The second story of the west wing is given up to mammals, and that of the east wing to minerals. In the third story (which is reached by a bridge) the west hall contains the collection of mammalian osteology, and the east hall the plants.

The basements are principally devoted to work-rooms and storage-rooms for duplicates and supplies; but at the extreme western end a cetacean gallery has been established, in which the entire collection of whale skeletons has been brought together.

There is one commodious apartment on the ground-floor which deserves special mention. It is designated as the students' room. Persons who have obtained permission to study in the museum can have brought into this room such specimens as they wish to examine. Tables and other conveniences are provided, so that investigations can be carried on with a very considerable degree of comfort. This system must commend itself to the officers of all large public museums, and to the students who resort to them.

It is manifestly impossible, within the limits of this article, to describe the cases used in the museum, or the modes of arranging specimens. Suffice it to say that the former are elaborate and costly, and appear to have been designed with much care, and that the latter are in most cases not only highly instructive, but artistic.

The chief excellence of the new structure lies in the series of annexes or galleries lighted from the top, and devoted to single groups of forms. This arrangement is in some sort an extension of the system of alcoves employed in numerous museums, but is greatly superior to the latter, on account of the size of the rooms and their complete isolation.

It is perhaps ungracious, where so much is admirable, to call attention to features which have the semblance of defects. Nevertheless, the building has been severely criticised by English naturalists, both on account of its architectural elaborateness and the faulty arrangement of its parts. The arrangement of the staircases is such as to occasion much unnecessary walking; and there is no way by which to move large specimens from the lower to the upper stories. The light in the alcoves of the central hall, devoted to the index collection, is insufficient, while along the entire southern façade it is admitted in such excess as to surely prove ruinous to the mounted specimens in the cases between the windows. There is no regular provision for a library.

It should be remembered, however, that no perfect structure was ever erected, and that the defects of this building are lost sight of in its general excellence. Its superiority over the old quarters at Great Russell Street is so great as to make comparison impossible.

The museum in Cromwell Road has somewhat more than a third more available floor-space than our national museum at Washington; but the capacity of the latter can be greatly increased by the addition of galleries. We are here comparing, however, a *part* of the British national museum with the whole of our own; for while the building at South Kensington is intended to contain only animals, plants, and minerals, the museum at Washington holds all the collections of the government illustrative of the three kingdoms of nature, and in addition those representing the history of the progress of culture and the arts.

After much agitation, the control of the natural-history collections has passed from the

MAIN FAÇADE OF THE NEW BRITISH MUSEUM OF NATURAL HISTORY ON CROMWELL ROAD.

hands of the principal librarian of the British museum to the newly appointed superintendent, who is styled director. The names of the keepers of the several sections are so well known as scarcely to need repetition. The staff, as now constituted, is as follows: —

Prof. W. H. Flower, director; Dr. Albert Günther, keeper of zoölogy; Arthur G. Butler, Esq., assistant keeper of zoölogy; Dr. H. Woodward, keeper of geology; R. Etheridge, Esq., assistant keeper of geology; L. Fletcher, Esq., keeper of mineralogy; W. Carruthers, keeper of botany. FREDERICK W. TRUE.

VEGETABLE MORPHOLOGY A CENTURY AGO. — GOETHE.

IN a previous article we have seen the conclusions reached in matters morphological by Linné and his contemporaries. Thirty years from the time of Wolff and Linné had passed away, when the appearance of Goethe's treatise on metamorphosis gave to the world once for all the true solution of Nature's problem, and, as becomes more and more apparent, determined for the nineteenth century the trend of its scientific thought. Goethe approached and stated the whole question anew; worked it out in his own persistent way; set forth with clearness the truths dimly hinted by Linné, by Wolff vainly declared; and by the splendor of his genius, and his attainments in matters purely literary, compelled the recognition of the world.

Goethe's discovery was a wonder to men of his day, is a wonder still. It is thought that the truth came to him by strange intuition, by special inspiration of some mysterious sort. His mind so surpassed that of ordinary men of talent that to his clear vision nought but truth appeared; as to a Newton, the propositions of simple geometry came without necessity of proof. But such was by no means Goethe's experience. Surely his imaginative genius suggested the idea involved; but the exposition of his theory came after months of laborious investigation, and observations repeated again and again. Furthermore, while the result proves that he made a most 'scientific use' of his imagination, it is also apparent that the poetic use of that faculty is never quite absent from his work. If his testing by observation the suggestions of his imagination is scientific, his fondness for generalization, his instinctive conviction of the unity of natural forms, and many of the details of his theory, are poetic in the extreme.

Goethe wrote of metamorphosis. The term 'morphology' does not appear in his writings until 1807. He uses the former word, however, to denote, not the actual conversion of any one organ into any other, but simply the correspondence of all organs discussed to one and the same ideal type.

In setting forth his theory, Goethe begins with the cotyledons, and shows them to be leaves after their fashion, differing in form from the ordinary leaf of the plant as they differ in function. He also notices that the first true leaves put forth are likewise not perfect, but are usually much narrower and simpler every way than those that follow. Goethe believes that the varying form of the leaf is due to variable nourishment. He regards the sap which nourishes these early leaves as very crude and poor indeed. He observes that the successive nodes of the stem receive each its sap through the medium of those below, and so each receives and furnishes to leaf and bud purer and more refined juices. Further, while the more imperfect fluids are constantly discarded, the purer are as continually assimilated and used, until Nature reaches her prescribed limits of growth: the leaves attain their greatest extent and perfection in development, and all is prepared for a new phenomenon.

Linné had shown that abundant bloom comes from scant nourishment. Goethe reasserts this, and argues, that, so long as raw material is to be disposed of, so long must all possible organs of the plant be converted into tools for the purpose. If too much nourishment is provided, the condition of blooming becomes impossible. Withdraw the nutrition, the organs of the node become more refined; the elaboration of juices unadulterated, purer and more refined takes place; the metamorphosis of the parts becomes possible, and forthwith ensues. When, in the light of present knowledge, we reflect upon the cost at which any plant puts forth its bloom, these century-old surmises of the poet seem to acquire new meaning and most peculiar interest.

In Goethe's time the involucre of a composite flower was still regarded as calyx, and acordingly the gradation from bracts to sepals was easy enough. This mistake does not, however, vitiate the poet's argument on this point; for he asserts the same transition in other plants, and cites the Compositae simply as affording the most patent illustration. He argues with perfect clearness, that the assembling about one point of several leaves, nay, even of several nodes, is not strange, as the same thing may be meetin every plumule. The